DIVERSIFIED REPRODUCTIVE TRAITS AMONG LOCAL POPULATIONS OF A FRESHWATER PRAWN, *MACROBRACHIUM NIPPONENSE* (PALAEMONIDAE: CARIDEA: DECAPODA) — EVIDENCE FOR A GENETIC BASIS

Varied egg and clutch sizes among local populations of the freshwater prawn *Macrobrachium nipponense* (de Haan) in Japan have been previously reported i.e. laying many small eggs (0.05 mm^3 in single egg volume) each spawning by estuarine populations, a few large eggs (0.1 mm^3) by inland freshwater populations, and a moderate number of medium-sized eggs by coastal lagoon populations (Mashiko, 1990). Such populations with different reproductive traits were occasionally found even within a single water system for instance, the Sagami River, central Japan (Mashiko, 1983a, b). The present study examines the genetic grounds for the different reproductive traits in this species.

Materials and Methods

Two groups of individuals, one spawning large eggs (0.100 mm^3 in mean egg volume: large-egg population), and a second producing small eggs (0.051 mm^3: small-egg population) were collected from the upper basin, and the estuary respectively of the Sagami River in 1988. The two sexes were reciprocally crossed between them, and viable F1 individuals were obtained as noted previously (Mashiko, 1984). A definite number of the F1 individuals were raised under the same defined conditions and the size and number of their eggs were examined when they bred the next year. As a morphological characteristic, the number of upper marginal teeth on the rostrum was also investigated for both of the laboratory raised and field-collected individuals.

Results and Discussion

F1 individuals produced by crossing the female of the small-egg population and the male of the large-egg population (S♀ x L♂) and by crossing the two sexes in inverse combination (L♀ x S♂), laid eggs of 0.071 and 0.075 mm^3 respectively. These egg sizes were intermediate between the large and small eggs of their parental populations. On the other hand offspring produced by crossing within the large-egg population (L♀ x L♂) and the small-egg population (S♀ x S♂) laid eggs of 0.102 and 0.051 mm^3, respectively - practically unchanged from the eggs of each parental population. Thus, the different egg sizes in this species is considered to be genetically controlled as a quantitative character. Similarly the results of crossing experiments suggested a genetic basis for different clutch sizes between the two populations.

The mean number of the upper marginal teeth on the rostrum differed significantly between the two populations in the field — 11.8 ± 0.8 (SD) and 12.5 ± 0.9 for individuals with large and small eggs, respectively ($P<0.001$, t-test). Hybridized F1 individuals exhibited an intermediate tooth number between them (12.4 ± 0.4 for both of L♀ x S♂ and S♀ x L♂), while F1 individuals obtained by crossing within populations showed virtually unchanged tooth numbers from each parental population (11.7 ± 0.9 for L♀ x L♂ and 12.7 ± 1.0 for S♀ x S♂; significant difference $P<0.001$, t-test). Therefore not only the reproductive traits, but the number of upper marginal teeth on the rostrum is considered to be genetically regulated. The mean number of the teeth varied from 11.7 to 12.9 among the 22 local populations examined in Japan. These results further confirm that this species is splitting into genetically distinct local populations with modified reproductive traits.

In all F1 individuals obtained by the crosses between and within populations, the mean survivorship was over 70% throughout the zoeal stages, and over 60% during the first six months of developmental, and there was no significant differences in survivorship noted. Almost all surviving females spawned eggs. Larvae hatching ability (defined as the ratio of the females successful in larval hatching to all berried females examined) was over 90% in all groups of F1 individuals. Thus no notable reduction in viability and fertility was recognised among the hybridized individuals. This suggests that, with reduced mobility of individuals (Mashiko, 1990) spatial separation of individuals in patchy habitats in inland waters is the major cause of reproductive isolation in this species.

Literature Cited

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